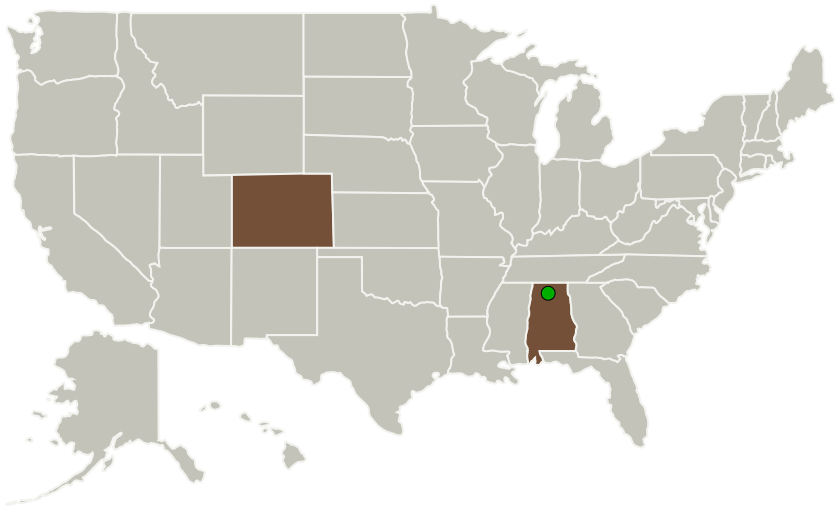
Low-cost, High Titanium Mare Simulant: Bulk, Dust and "Orange Spheres", Phase I

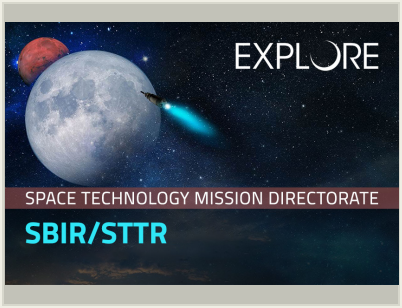
Completed Technology Project (2011 - 2011)

Project Introduction

Space exploration require simulants for equipment design, development and testing. This proposal directly responds to the solicitation by improving simulant fidelity, availability, and cost, by developing an innovative process to chemically enrich a low cost feedstock and manufacturing high titanium dust and spheres. Lunar regolith contains varying amounts of titanium oxide (up to 16% TiO2). JSC simulants contained only 1 to 2 %. This SBIR will produce a mare dust simulant from a synthetically prepared feedstock that contain two levels of TiO2 up to approximately 16%. The full simulant will include glass, pseudo-agglutinate and crystal material. Experiments will be conducted to produce spheres from the high-titanium material. Chemically enhanced simulant (bulk, dust, "orange" spheres) will provide a new level of fidelity that has not been realized to date. The estimated cost per ton of the high-titanium feed stock material will be less than $9,000 per ton. By producing high titanium Mare, bulk, dust and spheres (with capability to manufacture volumes beyond laboratory testing), ZAP will improve fidelity, reduce cost and schedules, improve processes, and develop abrasion and adhesion characterization techniques and methods. This Phase I program will deliver the following: ↓ High Titanium Simulant - Chemically enriched basaltic lunar simulant material - Bulk (combining glass, pseudo-agglutinate , crystal), dust, "orange" spheres ↓ Experimental adhesion and abrasiveness results and comparisons ↓ Cost & Schedule Analysis -Indentify cost and schedule versus fidelity, process improvements, and other variables Outcomes include an economical way to produce material, improved simulant availability, cost and fidelity that addresses needs within multiple NASA centers, and leverages previous investments in ZAP's patented material production capability.

Primary U.S. Work Locations and Key Partners





Low-cost, High Titanium Mare Simulant: Bulk, Dust and "Orange Spheres", Phase I

Table of Contents

Low-cost, High Titanium Mare Simulant: Bulk, Dust and "Orange Spheres", Phase I

Completed Technology Project (2011 - 2011)

Organizations Performing Work	Role	Type	Location
Zybek Advanced Products, Inc.	Lead Organization	Industry	Boulder, Colorado
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Colorado

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138275)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Zybek Advanced Products, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Michael Weinstein

Co-Investigator:

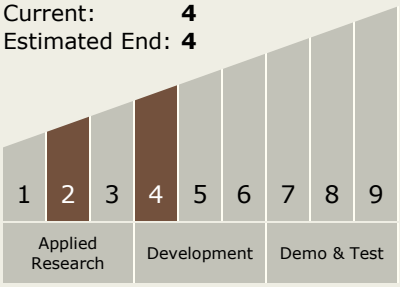
Michael Weinstein

Low-cost, High Titanium Mare Simulant: Bulk, Dust and "Orange Spheres", Phase I

Completed Technology Project (2011 - 2011)

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.7 Special Materials

Target Destinations

Earth, The Moon, Others Inside the Solar System, Outside the Solar System, The Sun, Mars